

## VII. The Breast-Feeding Dilemma

### *HIV Risks from Breast-Feeding, Benefits of Breast-Feeding, and Health Risks from Not Breast-Feeding*

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In this presentation, I will review the benefits of breast-feeding, the state of knowledge regarding the risk of HIV transmission through breast-feeding, and the risks of not breast-feeding.

Breast-feeding is economical and convenient for the mother and provides sound nutrition. It contains, in an easily digested form, all the nutrients an infant requires for at least the first 4 months of life, and usually for the first 6 months, and can be an important source of nutrition up to age 2 years. Nutrients in breast milk which may not be available in other foods include:

- High quality protein
- Long-chain polyunsaturated fatty acids, thought to be essential for the infant's developing brain
- Micronutrients, including iron, in a form that is efficiently absorbed

Breast milk, being a source of immunologically active cells and immunoglobulins, protects infants against infection. The protective effect of breast milk has been the subject of numerous investigations and reports in the literature. The available data indicate that the protective effect of breast-feeding is clearest for enteric pathogens, and some data suggest protection against respiratory infections, sepsis, and meningitis, and lessened severity of illness once a child becomes infected.

Successful breast-feeding promotes psychosocial development and bonding between the mother and infant. Breast-feeding also promotes maternal health and child survival by lengthening birth intervals, whether through producing amenorrhea and anovulation or through culturally prescribed sexual abstinence during lactation.

In summary, breast-feeding is normally the best way to feed infants, with benefits that go beyond sound nutrition, and children should not be needlessly deprived of it. However, breast milk also can be a source of infection by several viruses, including CMV, HTLV-1, and HIV-1. HIV-1 has been cultured from the breast milk of HIV-infected women; HIV nucleic acids have been identified by polymerase chain reaction in the cellular and noncellular fractions of human milk, both colostrum and later milk; and HIV-specific antibodies, both IgA and IgM, have been found in the breast milk of infected mothers when these antibodies were not present in serum.

The epidemiologic evidence for HIV transmission through breast-feeding comes

from ecologic comparisons, cohort studies, and case reports. Overall mother-to-child HIV transmission rates have been consistently higher in populations with high proportions of mothers breast-feeding than where breast-feeding tends to be less common. Of published cohort studies comparing mother-to-child HIV transmission rates in breast-fed and formula-fed infants, most have found higher rates among the breast-fed children, with a few exceptions. Evidence for breast-feeding transmission also comes from studies in which the HIV-infection status of breast-fed infants is closely monitored. In these studies, HIV infection subsequently has been diagnosed in infants who tested negative for HIV by polymerase chain reaction in the first 3-6 months of life. Additional evidence for breast-feeding transmission comes from case reports showing transient HIV seroreversion in infants, and HIV infection in infants whose mothers were themselves infected with HIV in the postpartum period.

In 1992, a meta-analysis of six papers reporting on nearly 1,800 women with established HIV infection was published. These studies compared risk of HIV transmission among breast-fed and bottle-fed infants. In this meta-analysis, the summary estimate of the difference in HIV transmission risk between breast-fed and bottle-fed infants was 14 percent (C.I. 7-22 percent)—this is the additional risk of transmission through breast-feeding, over and above in utero and intrapartum transmission. Four of the six studies included in this meta-analysis involved women from industrialized countries, where breast-feeding is generally of shorter duration. A repeat meta-analysis presented at the Global Meeting on Perinatal HIV Prevention last September included three new studies in developing countries. This second meta-analysis, by John and colleagues, documented a 17 percent additional risk.

It has been possible to directly estimate the risk of breast-feeding transmission only in the late postnatal period because, by then, breast-feeding transmission can be distinguished from intrapartum transmission. These direct estimates come from studies monitoring the HIV infection status of groups of infants known to be uninfected at 3-6 months of age, and whose only known exposure to HIV was through their mothers' breast milk. These studies, while unable to estimate transmission risks through breast-feeding before 3-6 months of age, have indicated that the risk is at least 4-12 percent after age 3-6 months, and 20 percent for children breast-fed at least 24 months. A recent meta-analysis including four cohorts in industrialized countries and four cohorts in developing countries estimated the late postnatal transmission rate at 5 percent.

There is evidence from several studies examined in the 1992 meta-analysis by Dunn, et al., that the risk of breast-feeding transmission is higher, 29 percent, if primary HIV infection of the mother occurs during lactation. Duration of breast-feeding is another factor which may modify risk of HIV transmission through breast-feeding. In the 1997 meta-analysis by Grace John and colleagues, women who breast-fed less than 6 months had an additional risk of transmission of 11 percent compared with 24 percent for women who breast-fed for 6 months or longer.

In addition to recent maternal infection and longer duration of breast-feeding, other

risk factors for breast-feeding transmission of HIV include mixed feeding (infants fed a combination of breast milk and formula appear to have risk intermediate between that of infants fed breast milk exclusively or formula exclusively for the first year of life). Other risk factors suggested in the literature include maternal immunosuppression (low CD4 lymphocyte count) and vitamin A deficiency, as both are associated with the presence of HIV-infected cells in breast milk, although their role in breast milk transmission has not been directly studied. Oral lesions in the infant may be associated with transmission, and cracked nipples and breast abscess have been implicated. Other factors include the presence of HIV-infected cells and lack of persistence of IgA and IgM in the mother's milk. HIV viral load has been noted to increase following withdrawal of antiretroviral therapy; however, whether this phenomenon increases the risk for breast-feeding transmission among women who used ZDV during pregnancy is not known.

Transmission of HIV can occur at any time during lactation, but an important question is whether the risk of transmission is constant or changing over the period of lactation. Because HIV has been isolated from colostrum, and a high concentration of lymphocytes is found in colostrum, an early hypothesis was that colostrum might have a higher concentration of HIV than later milk. But a recent study has found that the prevalence and concentration of HIV-infected cells is significantly higher in milk from days 8-90 after delivery than in colostrum. The prevalence and concentration of cell-free virus has also been found to be higher in mature milk than in colostrum. Together with the fact that infants take a greater volume of later milk, this evidence argues that later milk might confer a higher risk than colostrum. However, the estimates of risk of late postnatal transmission after age 3-6 months (5 percent from the meta-analysis) do not account for all of the (24 percent) risk attributable to breast-feeding beyond 6 months, suggesting that early postnatal transmission is also occurring. The period of lactation when risk of HIV transmission is highest has yet to be identified.

That breast-feeding transmission of HIV is an important public health problem is indicated by the estimate that, in breast-feeding populations, more than 30 percent of perinatal HIV infections are attributable to breast-feeding. The proportion of HIV transmission attributable to breast-feeding will only increase as the short-course ZDV regimens which prevent infections before or during delivery are implemented. If the additional risk of transmission through breast-feeding is taken to be 14 percent, for every 1 million children breast-fed by HIV-infected women, 140,000 additional children could be infected through breast-feeding.

The most effective method of preventing breast-feeding transmission of HIV is breast milk avoidance. This is the recommended approach in the United States and in other countries where risks of not breast-feeding are relatively low. Early weaning also has been proposed as a way to maximize nutritional benefits and minimize HIV transmission and other infectious disease risks. Further work is needed to define the optimal period of breast-feeding. Providing an alternate source of breast milk from a wet nurse or milk bank is a

possibility but presents the problem of ensuring that the donors are and continue to be uninfected with HIV. Treatment of expressed breast milk has also been discussed. In a study of breast milk from uninfected women to which HIV was added, Orloff and colleagues at CDC demonstrated that heat treatment of the virus-spiked breast milk at 62.5 degrees C for 30 minutes reduced the infectious titer of cell-free and cell-associated virus by more than 5 and 6 logs, respectively. Whereas it is routinely used by milk banks, pasteurization is not currently recommended and may not be feasible for home use. Finally, a theoretic approach to reducing transmission by breast-feeding is to provide antiretroviral drugs to lactating mothers and/or to the baby to provide “post-exposure” prophylaxis. However, this has not yet been studied.

In comparing the risks and negative consequences of breast-feeding with the risks and negative consequences of not breast-feeding, we find that the list of risks for not breast-feeding is longer. But the decision to breast-feed or not to breast-feed is more complicated than this quick comparison of list length might suggest. To review the list for not breast-feeding:

- In many developing country settings, there is increased risk of infection and increased severity of illness in children not breast-fed. Bottle-feeding of infant formula has been associated with a 1.5- to fivefold increase in mortality.
- Two reports in the literature have suggested that among HIV-infected children, those who are not breast-fed have faster progression to AIDS. These data are difficult to interpret because the investigators were unable to control for any dissimilarities between the compared groups in timing of transmission and other factors.
- Finally, not breast-feeding is likely to have an impact on birth spacing, with potentially negative consequences for the mother’s health and the child’s survival, and in populations where breast-feeding is the norm there may be social stigma and fear of HIV status being known for women who do not breast-feed.

Although this is a long list, I would like to point out that there is the potential to minimize the risks and negative consequences of not breast-feeding; however, for breast-feeding the main risk or negative consequence is HIV transmission which, if it occurs, certainly means the premature death of a child. An area needing further research is whether the nutritional content of HIV-infected mothers’ breast milk compares with that of uninfected women, i.e., whether the infants of HIV-infected women are getting the same benefits of breast-feeding. Because we need to be thinking about what is best for the mother and child as a pair, more research is needed on the effect of lactation on the mother’s health status in the presence of HIV infection.

Several investigators have attempted to use mathematical models to offer guidance to policy-makers in weighing the risks and benefits of breast-feeding and alternative feeding under different circumstances. These models are limited by available data and in the ability to consider all factors which bear on decision-making about infant feeding policy. I will not go into detail about the methods used, but two points are worth mentioning: Models

developed by Kuhn and Stein and published in 1997 and earlier by Hu, et al., (1992) have confirmed that under certain circumstances (that is, when there is a high relative risk of mortality from not breast-feeding, as is common in many developing countries) avoidance of all breast-feeding by the whole population always produces the worst outcome (highest mortality for children less than 5 years of age). These results support protection and promotion of breast-feeding among HIV-uninfected women. A modeling exercise that is currently underway is addressing whether, under certain circumstances, avoidance of breast-feeding by HIV-infected women may have an even greater prevention impact than interventions such as ZDV that reduce intrauterine and intrapartum HIV transmission.

As we turn attention toward policy about breast-feeding, the focus will also be on the key pieces of data that are currently missing. Some of these data gaps include:

- The timing of HIV transmission through breast milk
- Mechanisms of transmission
- The effectiveness of short-course ZDV treatment in breast-feeding populations
- The effect of antiretroviral treatment on viral load in breast milk
- The best infant feeding options for HIV-infected women in different settings
- Ways to minimize the risks of alternatives to breast-feeding
- Barriers to acceptance of and adherence to best infant feeding options

In summary, HIV transmission through breast-feeding represents an important mode of transmission that should be addressed by prevention efforts. However, breast-feeding is critical to overall child health, making this issue very complex. The ability to address breast-feeding transmission of HIV without increasing infant morbidity and mortality from other causes depends on (1) targeting interventions to HIV-infected women and (2) minimizing risks of alternative infant feeding methods.

***Policies Regarding Breast-Feeding in Developing Countries;  
Possible Programmatic Approaches to Reducing Breast-Milk-Associated  
HIV Risk; and Pros, Cons, and Information Needs***

**Presented by Isabelle DeVincenzi, M.D.**

**UNAIDS**

In 1997, WHO, UNICEF, and UNAIDS issued a joint policy statement on HIV and infant feeding, which takes account of available scientific evidence of transmission through breast milk and which promotes fully informed choice of infant feeding methods by HIV-positive women. Based on this 1997 statement, the two UN agencies and the UNAIDS secretariat developed guidelines intended to help decision-makers and health care managers.

Last month, a meeting was held in Geneva to discuss implementation issues related to these guidelines. I will discuss here the guidelines for decision-makers only, but the content

of the guide for health care managers is very similar, since the two documents were developed simultaneously.

We emphasize that infant feeding cannot be an isolated issue and infant feeding policy should be viewed in a broader context that includes the following assumptions:

- Preventing HIV infection in women will remain the best way to avoid mother-to-child transmission of HIV.
- All policy should be developed with respect for children's and women's rights, with the best interests of the mother and baby as a pair in mind.
- A policy on infant feeding and HIV that is based on meeting the needs of individual mothers and infants requires that women know their HIV status. Improving access to counseling and testing for all women and their partners in antenatal care, family planning, and all other appropriate points in the health service is necessary to implement both antiretroviral treatments and an infant feeding policy to reduce mother-to-child transmission.
- We should strengthen antenatal care services and encourage increased attendance so that women can be provided information about prevention of HIV infection, offered HIV counseling and testing, and offered an intervention to reduce mother-to-child transmission and referred for infant feeding counseling if HIV-positive.
- We should implement other interventions to prevent mother-to-child transmission.
- We should strengthen family planning provision to give women the option of avoiding pregnancy if they wish.
- Breast-feeding, which remains the best source of nutrition for the great majority of infants, still should be promoted, supported, and protected. In addition, care should be taken to prevent a spillover effect in which fear of HIV infection undermines the commitment to breast-feed, even among women who are not infected, and undermines support by health systems and policy for breast-feeding.

Breast-feeding is normally the best way to feed infants, with benefits that go beyond sound nutrition, and children should not needlessly be deprived of it. Breast-feeding provides:

- *Nutrition.* Breast milk provides, in an easily digested form, all the nutrients an infant requires for at least the first 4 months of life, and usually for the first 6 months. Breast milk continues to provide high quality nutrients until a child is at least 2 years old. From 6 to 12 months, breast-feeding can provide up to half or more, and from 12 to 24 months up to one-third, of a child's nutrient requirements.
- *Protection.* From the moment of birth, breast milk actively protects infants against infection. It contains numerous anti-infective factors, including immunoglobulins and white blood cells, and growth factors. No artificial foods contain these anti-infective and growth factors. Some studies show that even with optimal hygiene, artificially fed infants suffer five times the rate of digestive infection of breast-fed infants and higher rates of respiratory, ear, and other infections.

- *Family planning benefits.* Breast-feeding delays the return of a woman's fertility. If a woman does not breast-feed, she is at increased risk of an early pregnancy.
- *Psychosocial development.* Breast-feeding is important to the emotional relationship between mother and child. A child who is not breast-fed may receive less attention from and stimulation by his or her mother.

The process of feeding a child who is not receiving any breast milk with a diet that provides all the nutrients the child needs is called replacement-feeding. Using a specific term for feeding a child in the absence of breast milk is helpful to distinguish it from complimentary feeding or various forms of artificial feeding which may be given in addition to breast milk. Support for adequate replacement-feeding is needed throughout the period for which breast milk is recommended and during which a child is at greatest risk of malnutrition, that is, until a child is at least 2 years old.

From birth to 6 months of age, milk in some form is essential. The milk should be prepared with careful attention to hygiene. This requires clean water to prepare the feed and fuel to boil the water, milk, and utensils. Options include commercial infant formula, which is designed to meet the nutritional needs of an infant for the first 4 to 6 months of life. It may be made from cow's milk or vegetable products such as soy bean. While important differences remain, these are the closest in composition to breast milk and are usually adequately fortified with micronutrients, including iron. Liquid ready-to-feed preparations are also available in some settings, but may be more expensive.

Home-prepared formula can be made from animal milk, typically from cows, goats, buffalos, or sheep. The composition of animal milk is different from that of human milk, and it may lack micronutrients. It is best if animal milk is modified for infants through dilution with water and the addition of sugar.

From 6 months to 2 years, replacement-feeding for a non-breast-fed infant should include a suitable breast milk substitute and complimentary foods made from appropriately prepared and nutrient-enriched family foods. If suitable breast milk substitutes are not available, replacement-feeding should be provided with appropriately prepared and further enriched family foods. Other milk products, such as unmodified animal milk, dry skim milk, or yogurt should be included if possible as a source of protein and calcium.

HIV-positive mothers who choose to breast-feed should consider early cessation of breast-feeding as soon as they can provide adequate replacement feeds. No specific time is recommended. Indeed, the best option for an HIV-positive mother is to use an adequate alternative from birth, while the worst option will be to continue to breast-feed for 2 or 3 years. Since it is not yet possible to propose a clear-cut point (no scientific data available) of replacement-feeding, we recommend that as soon as an HIV-positive woman has access to adequate replacement-feeding she should consider cessation of breast-feeding.

Expressing and heat-treating the breast milk or using a breast milk bank may be other options. While wet nursing in the family context is traditional in some cultures, there is a risk of HIV transmission to the infant if the wet nurse is infected, and a possible risk of

transmission to the wet nurse if the infant is infected. If a family considers this option, both the mother and wet nurse should be fully informed about the risks. The wet nurse should be offered HIV counseling and testing and be able to practice safe sex to remain HIV-negative while breast-feeding the infant.

To make an informed decision about how to feed their babies, mothers need to know whether or not they are HIV infected. This requires that voluntary and confidential counseling and testing be provided and promoted. It is a fundamental principle that testing be voluntary and carried out with informed consent. Decision-makers also need to consider coverage. The ultimate goal is to provide widely available counseling and testing for the whole population. In the context of mother-to-child transmission, it is particularly important that counseling and testing services be available for women of child-bearing age and their partners. It is recommended that services for women also involve partners when the woman so chooses, and that it be a duty of staff to encourage and facilitate this process.

Counseling is an intensive, skilled, and time-consuming process that must answer a range of client needs. Every client must receive pre- and post-test counseling, and those who are HIV-positive are likely to require further counseling and support. In the case of pregnant and postpartum women, this will include counseling related to breast-feeding and replacement-feeding.

ELISA testing requires skilled technical staff, well-maintained equipment, and a steady power supply. Rapid and simple antibody tests do not need such specialized equipment or staff. However, same-day-result tests may not be adequate where women need more time to fully cope with learning about their results.

The policy objective must be to minimize all infant feeding risk and to urgently expand access to an adequate alternative so that HIV-infected women have a range of choices. The policy also should stipulate what measures are being taken to make breast milk substitutes available and affordable, to teach the safest means of feeding them to infants, and to provide the conditions which will diminish the risks of using them.

Decision-makers particularly need to consider the following:

- What will it cost the government to offer HIV-positive mothers subsidized or free supplies of breast milk substitutes, and how should such a program be financed and sustained? If the government offers free or subsidized breast milk substitutes to some or all HIV-positive mothers who choose not to breast-feed, these mothers must be ensured of breast milk substitute for at least 6 months and support for continued adequate replacement-feeding up to 2 years of age, including some form of milk if possible up to at least 1 year.
- What is needed in addition to affordable breast milk substitutes to make alternative feeding as safe as possible? The risk of giving replacement feeds must be less than the risk of HIV transmission through breast-feeding or there is no point in using them. Essential elements include knowledge and commitment on the part of the caregivers, safe water, assured supplies of affordable fuel, easy access to quality health care for

- mothers and infants, and a good level of support from counselors or social workers.
- What are the implications for family planning services? A policy recommending that HIV-infected mothers be counseled to consider replacement-feeding can have major implications for birth spacing. HIV-infected mothers deprived of lactational amenorrhea will become pregnant earlier with adverse health consequences for themselves. Ultimately, a higher number of HIV-infected children will be born and will need to be cared for. Family planning information and services need to be readily available to mothers and their partners.
- What is necessary to manage the efficient distribution of breast milk substitutes to HIV-positive mothers? If free or subsidized breast milk substitutes are to be offered, they need to be distributed efficiently to the mothers who are eligible for them, but controlled to prevent spillover to mothers who are HIV-negative or have unknown status. Possible ways to achieve this are (1) centralizing procurement of supplies, both to enable negotiation of good prices and to facilitate control and monitoring of distribution; (2) giving breast milk substitutes only to mothers who have had HIV counseling and testing and are known to be positive; (3) distributing breast milk substitutes to local distribution points in appropriate quantities for the expected number of tested, HIV-infected women; and (4) giving breast milk substitutes through an accountable system of medical prescriptions or coupons, for example, through a pharmacy in the same way as medicines.
- How do we prevent spillover? We must ensure that health education programs continue to emphasize the value of breast-feeding and the risks of artificial feeding. Information about mother-to-child transmission should be given in a way that does not frighten mothers who are HIV-negative or of unknown status and lead them to avoid breast-feeding unnecessarily. We must also ensure that all staff members who counsel mothers about replacement-feeding are trained in breast-feeding counseling. And we must take measures to implement the international code of marketing of breast milk substitutes. Health care workers should know about their responsibility under the code and apply them in their work.

Providing information, education, and communication (IEC) is a very important element in a comprehensive policy on infant feeding, both to raise public awareness of the issues and to encourage public debate that is based on accurate information. An IEC component aimed at encouraging public debate about HIV and infant feeding issues should have the following goals:

- To move beyond a simple message of prevention that tends to reinforce the image of HIV/AIDS as a hopeless disease.
- To counter denial of the existence of HIV and prevent prejudice and discrimination against those infected.
- To provide facts about mother-to-child transmission, including the availability of a preventive intervention.

- To reinforce messages about the value and importance of breast-feeding by women not known to be HIV-positive.
- To reinforce messages about the benefits of adequate antenatal care.
- To provide the facts about treatment options for people with HIV/AIDS and practical information about where to go for care, support, and counseling.
- To inform people about the benefits of counseling and testing, to give them practical information about where services are available and how to use them, and to stimulate a public debate about testing.
- To reinforce messages about the benefits of family planning and contraceptives.

In the area of professional education and training, decision-makers need to consider: What staff are available who already have been trained in HIV counseling or infant-feeding counseling? Who will be responsible for infant-feeding counseling and what new staffing arrangements might be required? How many more staff with skills in breast-feeding and replacement-feeding counseling will be required? How will they be trained? What extra knowledge and skills will general health workers need regarding both HIV and infant-feeding? What modification or addition to the curriculum of professional training courses will be required? And what resources will it be necessary to allocate?

Decision-makers will need a thorough understanding of the situation regarding HIV/AIDS locally to formulate appropriate and effective policy. Information needed to develop sound policies includes identification of interested parties and key players; estimation of the number of mothers and infants likely to be affected; assessment of the extent to which people infected with HIV are stigmatized and of the possible social and cultural barriers to counseling, testing, and replacement-feeding; assessment of attendance at antenatal care, family planning, and related facilities; availability of voluntary and confidential counseling and testing for HIV; review of existing child-feeding practices, including availability and cost of replacement feeds, and morbidity and mortality associated with artificial feeding; assessment of average families' access to safe water, sanitation, and fuel, and feasibility of preparing replacement feeds safely; and availability of funding.

After assessing the situation, decision-makers should focus on the following priority tasks for implementing policy on HIV and infant feeding: developing counseling and testing services for HIV that are integrated into the maternal-child health services, developing training and guidelines on infant feeding for different personnel, planning and developing a counseling service for breast-feeding and replacement-feeding that is integrated into maternal and child health services, assessing additional family planning and contraceptive needs, allocating responsibility for the various tasks to be performed, and developing and disseminating messages for the general public. If it is decided to provide free or subsidized supplies of breast milk substitutes, governments must organize the procurement of breast milk substitutes, arrange their distribution through the health services or other distribution points, and set up mechanisms for controlling and monitoring their distribution.

Monitoring and evaluation should be a routine part of planning in all programs.

These activities encourage efficiency and commitment to time frames, draw early attention to problems, and suggest what can be done to overcome them. Monitoring health outcomes, including HIV status and growth in children of HIV-positive mothers who breast-feed or feed artificially and health effects in other children and family members of women who artificially feed, will help in refining national policies and counseling practices.

Monitoring breast-feeding rates in HIV-negative women will indicate whether spillover effect is occurring and enable steps to be taken to counter this trend if necessary.

Finally, it should be remembered that the efficacy of ZDV for breast-fed children is currently not known, and the greatest reduction in mother-to-child transmission is likely to occur when the provision of ZDV and a safe alternative to breast-feeding are combined. However, if a woman chooses not to use ZDV and a safe alternative to breast-feeding, she should still have access to the intervention of her choice and should be supported to carry out the use of this intervention safely and effectively.

### ***Experience with Breast-Feeding Modification: Lessons Learned***

**Presented by Glenda Gray, M.D.**

**University of Witwatersrand/Baragwanath Hospital**

This talk is divided into two parts: The first part will look at the practices of HIV-infected women regarding infant feeding and the reason why they choose to breast-feed or to formula-feed, and the second part will look at some of the children from the PETRA Study and compare the growth and illness in children who were breast-fed with those who were formula-fed.

I do not have a picture of Soweto, but I do have some pictures of famous women from Soweto. Soweto is situated just outside Johannesburg. There are about 3 million people in Soweto. Johannesburg and Soweto are in the province of Gauteng, which is probably the richest province in South Africa and probably the richest area in Africa. I am presenting data from Soweto, which has an infant mortality rate of about 50 per thousand. I would like you to consider what I am presenting in the context of an urbanized, affluent, middle-income setting.

Soweto was the cradle of the revolution and was one of the areas in South Africa that pushed for a democratic South Africa. In terms of empowerment, the women in Soweto and the women in South Africa pushed for a democratic South Africa and have been instrumental in moving policy in our country in terms of trade unions, in terms of health, and in terms of politics.

After the first study that we did in Soweto, a cohort study that looked at women who self-selected into breast-feeding and formula-feeding groups, we wanted to know why women chose to breast-feed or why women chose to formula-feed. In particular, we wanted

to see what factors affected their choice in our situation.

Fifty-two percent of South Africans are urbanized. Soweto has a population of 3 million people. We have 20,000 deliveries annually, of which 17,000 occur in our hospital. About 8,000 women enroll in our antenatal clinic, and about 8,000 are referred to our unit in the maternity section in late pregnancy and during delivery and may not have access to voluntary counseling and testing. At our antenatal clinic, voluntary counseling and testing is offered and HIV testing occurs after a woman has signed informed consent.

The aim of this study was to determine the infant feeding practices of HIV-infected women at the Chris Hani Baragwanath Hospital, to define the reasons for their feeding choices, to document the effects of introducing a subsidized formula, and to assess the safety of formula preparation.

Halfway through the study, we introduced subsidized formula in our antenatal clinic. The unit purchases formula at state price and is very fair: one month we purchase S-26, which is by InfantCare; the next month we purchase Similac, which is made by Abbott; and the third month we purchase Nestle. So every 3 months we alternate the formula in our setting.

As mentioned, all women who book at our antenatal clinic have access to voluntary counseling and testing. At post-test counseling, HIV-positive women receive information about the benefits and the risks of breast-feeding versus formula-feeding. This is done by the nurses and by our counselors. Most women that we interviewed were enrolled into the PETRA Study (UNAIDS) which examines the use of a combination of ZDV and 3TC in an attempt to reduce mother-to-child transmission.

Of 274 women who were eligible for the study, 245 delivered at our Chris Hani Baragwanath Hospital. Of these, 212 were interviewed—100 before we subsidized the milk, and 100 afterwards. Seventy-nine percent of eligible women were interviewed, and we have analyzed data on the first 185. Eighty-one women were enrolled into our PETRA Study, 40 were not enrolled, and 64 were enrolled after the subsidy was introduced.

We administered a semi-structured questionnaire to HIV-positive women who delivered consecutively between the 1st of February and the 30th of September in 1997. The interviews were conducted 1 month after delivery. We chose 1 month because we felt that, by that time, the feeding practices would have been established and women would not know the HIV status of the child, so this would not affect their beliefs about or choice of feeding.

In contrast to studies in Côte d'Ivoire and possibly other parts of Africa, the mean age of the mothers was 26.7 years. We had women who were as young as 14 years of age who were enrolled into our PETRA Study with the condition that they disclose to their parent and bring their parent with them for support.

Also in contrast to Côte d'Ivoire, the median years of education was 10 years, so these women had a lot of schooling. Most of them lived in a house. Also, perhaps in contrast to the rest of Africa and typical of an urbanized setting in South Africa, 93 percent of the

women had tubs at their home, either inside or outside, and only 7 percent of the women, even though they lived in formal settlements or squatter camps, had a community tub (usually just up the road from their place of abode).

Regarding feeding choices at 1 month, being enrolled in the PETRA Study influenced the decision not to breast-feed compared with women who were not enrolled in the study.

A very small percentage of women exclusively breast-fed, both in the nonenrolled and enrolled patients. Some were partial breast-feeders (breast and water) and some were mixed feeders. In some cases, you see the breast-feeding stopped in the enrolled and the nonenrolled patients. Thus, being enrolled in the perinatal transmission study significantly increases the never-breast-fed group.

What are the factors that are not associated with feeding choices? The age of the mother was not associated with her choice to breast-feed or formula-feed; her educational level also did not appear to be associated with whether she chose to breast-feed or not. The occupation of the mother or her current partner was not significantly associated with her choice. Quite surprisingly, we found that her choice to breast-feed or not to breast-feed was not associated with whether she had disclosed her status to someone. In fact, 67 percent of the women in the study actually had disclosed their status to either their partner or a member of the family. Also, we thought that maybe women who were in denial about their HIV status would choose to breast-feed, but this was not associated with their choice.

So why did women choose not to breast-feed in the PETRA study? Obviously, one of the biggest reasons why women chose not to breast-feed in our study was the knowledge that breast-feeding could increase transmission. Eleven percent of the women who were breast-feeding did not know that HIV could be transmitted through breast-feeding. We found that having more than one counseling session increased the incidence of women choosing not to breast-feed. In addition, women who lived in houses chose not to breast-feed.

Forty percent of women who chose not to breast-feed in fact lived in squatter camps. We also found that attending the antenatal clinic more often was associated with a woman's choice not to breast-feed. Thus, access to health care information, access to health education, and access to counseling increased the incidence of not breast-feeding.

What happened when we introduced subsidized formula into our clinic? Once we introduced the subsidized formula, we had a significant increase in the women who chose not to breast-feed. It did not change the mixed feeding, the stopping of the breast-feeding, exclusive breast-feeding, or partial breast-feeding—introducing milk into the clinic actually increased the never-breast-fed group, which was quite interesting.

How did women in our cohort prepare the feeds? We defined major hygiene problems when women were not sterilizing their bottles by boiling the water and cleaning the teats. All women used bottles in our cohort; no one used cup and spoon. We defined major mixing inaccuracies in the group if they put two scoops more or two scoops less in

their bottle.

I am very keen on the generic bottle, because there is some confusion about measurement—in South Africa, the bottles have ounces and mils, and the women confused the 1, 2, or 3 ounces with the amount of scoops they need to put in. I think we need to make a generic formula, a generic bottle, or a generic cup to try to circumvent these problems.

People always think about bonding and the effect of not breast-feeding on this relationship, and a fair number of women perceived a negative effect by not breast-feeding. Interestingly enough, the one person who was not bonding with her baby was in fact a woman who breast-fed. The interviewer assessed almost all of the other women as having bonded with their babies. So it did not seem to affect the interviewer's interpretation of bonding.

In conclusion, I can say that a large majority of women in the PETRA Study chose not to breast-feed. Providing subsidized formula did have a significant effect on the frequency of breast-feeding. We feel that counseling and support are probably more important than the subsidizing of the formula. In addition, a minority of women who do prepare formula require more attention and more input by providers. Obviously these interventions occurred in an antenatal clinic, a research center with many counselors and good care; can we generalize these results into our community?

We are now piloting five projects in our region at a clinic level. In the next 2 months, we will pilot the Thai regimen with formula-feeding, looking at the distribution of formula and the distribution of drugs at a clinic level.

I now will present data on about 135 children that reached 1 year of age in the PETRA Study. These children were enrolled at the beginning of the study before we subsidized feeding, and we are comparing the formula-fed group with the breast-fed group in this area.

So here we have 135 children who have just entered the PETRA Study; 41 percent were breast-fed, and 58 percent were formula-fed. We had five deaths in the breast-fed group and seven deaths in the formula-fed; the percentage in both groups was the same, so there was no difference in mortality in the two groups.

When looking at growth, the rates are very similar when comparing formula- and breast-feeders. The formula-feeders were behind a little bit after birth; the breast-feeders at 6 weeks weighed about 200 grams more than the formula-feeders. Their weights are comparable between 3 and 6 months; at 9 months the formula-feeders seem to weigh a little bit more, and it seems to become equal at a year.

In terms of hospital admissions, among the 135 children, we had 13 hospitalizations—11 percent in the formula-fed group and 9 percent in the breast-fed group, that is, 9 children in the formula-fed and 4 in the breast-fed group.

Among children in the formula-fed group, seven were admitted for lower respiratory tract infections and two for gastroenteritis.

In the breast-fed group, two were admitted with bronchopneumonia and two with gastroenteritis (50 percent with bronchopneumonia and 50 percent with gastroenteritis in the breast-fed, and 22 percent with gastroenteritis in the formula-fed group).

When looking at ambulatory visits, we find that the breast-feeders and formula-feeders are somewhat similar. The incidence of otitis media, lower respiratory tract infections, and gastroenteritis are quite similar for ambulatory visits by the two groups.

These data support the fact that in an urban setting such as Soweto, which has a low infant mortality rate of 50 per thousand and access to water and good medical facilities, children who are formula-fed in this situation did not fare badly.